SEMESTER VI

EE1603 POWER ELECTRONICS (3-1-0)

Power Semiconductor Drives:

History of development of Power electronic Drives, Constructional features; Characteristics, rating and specification, gate/base drive circuits; Protection including cooling and application of diodes; SCRs, GTOs, BJTs,MCT,MOSFET and IGBT; Electromagnetic interferences.

AC to DC converters:

Operation and analysis of single phase and multi-phase uncontrolled and controlled rectifiers with R,R-L, and back EMF load, effect of source inductance, Freewheeling effect; Power Factor Improvement methods for Phase-Controlled rectifiers; Filters.

AC to AC converter:

Operation and analysis of single- phase integral cycle and phase controlled converters; Configuration of three- phase controllers.

DC to DC converters:

Single phase and their phase bridge inverters, VSI and CSI, voltage control- PWM and square wave operation; Harmonics and their reduction techniques.

Cyclo- converters:

Single-phase and three phase configuration and operating principle.

EC 1612 SIGNALS & SYSTEMS (2-1-0)

Dynamic Representation of Systems

Systems Attributes, causality linearity, Stability, Time-invariance; Special Signals, Complex exponentials, Singularity functions – Impulse and step functions; Linear time invariant systems; Differential equation representation, Convolution integral, Discrete form of special functions, discrete convolution and its properties, Realization of LTI- Differential and Difference equations.

Fourier analysis of Continuous Time Signals and Systems

Fourier series, Fourier Transform and properties,Parseval's theorem, frequency response of LTI systems; Sampling theorem;

Fourier analysis of Discrete Time Signals and Systems

Discrete Time Fourier Transform, and properties, Frequency response of discrete time LTI systems;

Laplace Transform

Laplace Transform and its inverse: Definition, existence conditions, region of Convergence and properties, Application and Laplace transform for the analysis of continuous time LTI systems; Significance of poles and zeros.

Z-Transform

Z-Transform and its inverse: Definition, existence conditions, region of Convergence and properties, Application of Z-Transform for the analysis of discrete time LTI systems; Significance of poles and zeros.

Random Signals

Introduction to probability; Bayes Theorem, Concept of random variable, Probability density and distribution functions, Function of a random variable ; Moments, Independence of a random variable; Introduction to random process; Auto and cross correlation; power spectral density, White noise, Random signal analysis;

Suggested Books &References:

- Oppenheim Alan, V., Willsky Alan. S., and Nawab, H. “Signal and Systems”. Prentice Hall, 1997.
- HaykinSymon, ”Communication Systems” , 3rd Edition, John Wiley, 1995.

EE 1605 DESIGN OF CONTROL SYSTEMS (3-1-0)

- Review of frequency response, Frequency domain specifications; Design of controllers for single loop systems in the frequency domain – Lag, Lead, Lag-Lead networks as compensators; Design of P, PDT,I,PI and PID controllers for first, second and third order systems; Control loop with auxiliary feedback, Feed forward control, Multivariable control.
- Ziegler and Nichol's methods, Oppelt's method; State variable representation of control systems; Design using state variable feedback;
- AC Carrier Control Systems
- **Modern Control Theory**
- Formulation of equations of a system – Linearization, Input-output relations, State space methods; State transition Matrix, Stability, controllability, Observe ability and Transfer Function
- Lyapunov's direct method, Sensitivity, Optimal control formulation, Calculus of variations, Performance indices, Pontryagin's maximum principle. Time optimal control, Principle of optimally, Dynamic programming.
- Pole placement, Quadratic performance index, Linear regulator problem.

EE-16 ELECTRICAL DRIVES(3-1-0)

Electrical drive: Concept, classification, parts and advantages of electrical dives.

Dynamics of Electrical Drives: Types of Loads, Components of load toques, Fundamental torqueequations, Equivalent value of drive parameters for loads with rotational and translational motion.
Steady state stability, Transient stability, Multiquadrant operation of drives; Load equalization;
Motor power rating: Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torqueand power methods for fluctuating and intermittent loads.
Starting of Electric Drives: Effect of starting on Power supply, motor and load;
Methods of stating of electric motors, Acceleration time Energy relation during stating, methods to reducetheEnergy loss during starting.
Breaking of Electric Drives: Types of breaking, breaking of DC motor, Induction motor and Synchronousmotor, Energy loss during braking;
DC motor drives: Single phase, three phases fully controlled and half controlled rectifier fed DC drives.
Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current. Choppercontrol of DC drives.

Induction motor drives: Stator voltage variation by three phase controllers, Speed control using chopperresistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and currentsource inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control.Synchronous motor drive: Variable frequency control, Self-Control, Voltage source inverter fedsynchronous motor drive, Vector control.

Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor driveIndustrial application: Drive consideration for Textile mills, Steel rolling mills, Cement mills, Papermills, Machine tools. Cranes & hoist drives.

Text Books:

1. Fundamental of Electrical Drives, G.K. Dubey, New Age International Publication.
2. Electric Drives, VedamSubrahmanyam, TMH
3. A first course on Electrical Drives, S.K. Pillai, , New Age International Publication.

Reference Books:

1. Electric motor Drives, R. Krishnan, Pearson Education. Modern power Electronics and AC drives, Bimal K Bose, PHI

ME1801 POWER PLANT ENGINEERING (3-1-0)

THERMAL POWER PLANT

Basic thermodynamic cycles, various components of steam power plantlayoutpulverized coal burners- Fluidized bed combustion-coal handling system sashHandling systems- Forced draft and induced draft fans- Boilers-feed pumpssuperheaterregenerator-condenser- deregenerators-cooling tower

HYDRO ELECTRIC POWER PLANTS

Layout-dams-selection of water turbines-types-pumped storage hydel plants

NUCLEAR POWER PLANTS

Principles of nuclear energy- Fission reactions-nuclear reactor-nuclear powerplants

GAS AND DIESEL POWER PLANTS

Type's open and closed cycle gas turbine, work output & thermal efficiency, Methods to improve performance-reheating, intercooling's, regeneration advantageand disadvantages- Diesel engine power plant-component and layout

NON-CONVENTIONAL POWER GENERATION

Solar energy collectors, OTEC, wind power plants, tidal power plants andgeothermal resources, fuel cell, MHD power generation-principle,thermoelectric power generation, thermionic power generation

TEXT BOOKS

1. A Course in Power Plant Engineering by Arora and Domkundwar, Dhanpat Rai and Co.Pvt.Ltd., New Delhi.

2. Power Plant Engineering by P.K. Nag, Tata McGraw Hill, Second Edition , Fourth reprint 2003.

REFERENCES()

1. Power station Engineering and Economy by Bernhardt G.A.Skrotzki and William A. Vopat- Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.

2. An introduction to power plant technology by G.D. Rai-Khanna Publishers, Delhi-110 005.

3. Power Plant Technology, M.M. El-Wakil McGraw Hill 1984.

EE 1601 MICROPROCESSOR & MICROCONTROLLER (2-1-0)

Architecture of 8085 Microprocessor:

Function Block Diagram-Registers, ALU, Bus System, Timing and Control signals, Machine Cycles and timing diagram.

Programming of 8085

Instruction format, Addressing Modes, Instruction set, Need for a Assembly Language- Development of assembly language programs.

Memory Interface:

Interface requirements-Address space partitioning-Buffering of Buses-timing constraints, Memory control signals, Read and write cycles, Interdicting SRAM, EPROM and DRAM section.

I/O Interfacing:

Memory mapping I/O scheme, I/O mapped I/O/ scheme, Input and output cycle, Simple I/O port, Programmable peripheral Interface (8255), Data Transfer Scheme: Programmable data transfer, DMA Data transfer, Synchronous, Asynchronous and Interrupt driven data transfer scheme, Interfacing, Simple Keyboards and LED Display.

Interrupts and DMA:

Interrupt feature, Need for interrupts, Characteristics of Interrupt, Types of Interrupts, **Interrupts** structure, Methods of servicing Interrupts , Developments of Interrupts service subroutines, Multiple Interrupt request and their handling, Need for direct Memory Access, Device for Handling DMA, Programmable DMA controller 8237.

Applications:

Interfacing of A/D converters (ADC 0800/ADC 8080/ADC 0809); Interfacing of DMA converters (DAC 0808), Waveform Generators, Multiplexed Seven Segment LED display Systems; Measurement of frequency, Phase angle and Power factor; Traffic Light Controller, Stepped Motor Control.

Intel 8051 Microprocessor:

Architecture of 8051; Memory organization, Addressing Modes; Instruction Set; Boolean processing; Simple Programs;

8051 Peripheral Functions:

8051 Interrupt Structures; Timer and Serial Functions; Parallel port features; Modes of operation: Power control; Interfacing of 8051; typical applications, MCS family features 8031/851/8751.

PRACTICAL:

EE 1609-P CONTROL SYSTEMS LAB (0-0-3)

List of experiments:

- Identification of transfer function of a system using Bode plots from exponentially obtained frequency response.
- Experimental study of characteristics of Synchro device & AC and DC servo motor.
- Position control of DC servo system with Lead / Lag compensator in the loop.
- Experimental study of a hydraulic servomechanism.
- Experimental study of a pneumatic system.
- PID tuning on process control simulator.
- Stepper motor control using 8-bit Microprocessor.
- PID control of thermal and / or liquid level system.
- Study of proportional, integral and Derivative control.
- Study of stability of a control mechanism.

Suggested Books & References:

- Gopal, M. "Control systems: Principles and Design", Tata McGraw Hill, 1997.
- Kuo, B.C. "DigitalControl systems" , 2nd edition, Saunders college publishing, 1992
- Ogata, K., "Discrete Time Control systems", Prentice Hall, 1987.

EE 1606-P POWER ELECTRONICS LAB (0-0-3)

List of experiments:

- Study of V-I characteristics of SCR, Triac and Diac.
- Study of BJT and IGBT, GTO and MOSFET.
- Study of a UJT firing circuit for the control of SCRs.
- To generate and study the PWM control signal for single- phase DC to Dc inverter.
- To study and use of the single-phase half controlled and fully controlled AC to DC Converter and effect of firing angle control on load Voltage and waveforms.
- To study and use of back to back connected SCR / Triac controlled AC Voltage controller and its wave forms with Variation of firing angle.

EE-16 ELECTRICAL DRIVES LAB (0-0-3)

1. Study of thysistor controlled DC Drive.
2. Study of Chopper fed DC Drive
3. Study of AC Single phase motor-speed control using TRIAC.
4. PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.
5. VSI / CSI fed Induction motor Drive analysis using MATLAB/DSPICE/PSIM Software.
6. Study of V/f control operation of 3Φ induction motor drive.
7. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.
8. Regenerative / Dynamic braking operation for DC Motor - Study using software.
9. Regenerative / Dynamic braking operation of AC motor - study using software.

PC/PLC based AC/DC motor control operation.

EE1607-P MICROPROCESSOR & MICROCONTROLLER LAB (0-0-3)

List of Experiments:

- Programming to add (i) two 8- bit numbers, (ii) two 16- bit numbers.
- Programming to find the smallest number in the data entry.
- To find large of two number.
- To find large number from a series of a number.
- To arrange a series of number in descending order.
- To find 1's complements of a 16-bit/8-bit.
- To find 2's complements of a 16-bit/8-bit.
- Programming to find multiplication of a two 8-bit Number.
- Programming to find a square root of a number.
- Programming and verification of speed control of a stepper motor.
- Programming and verification of seven segment display.

Suggested Books & References:

- Gaonkar, R.S., "Microprocessor Architecture Programming and application with the8085/8080A", 3rd Edition, Penram international Publishing House, 1997.
- Kenneth, L.Short." Microprocessor and Programming Logic" Pretice Hall of India 2ndEdition, 1987.
- Microcontroller Hand Book, INTEL, 1984.